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(54) Packet transmission system.

(57) A packet transmission system comprising a network of one or more nodes (1) each comprising a number of inputs connected via packet switching means to a number of outputs each of which has storage means (11) associated with it in which to store a queue of packets to be outputted; characterised in that each node (1) is provided with timer means (14) to measure the time each packet spends in a queue of said storage means (11); and stamping means (12) to add to a time stamp field (TS) of each packet before it is outputted from the node, the time the packet has spent in a queue as measured by the timer means (14).

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incide with the address field AD in the packet header. This control line 10 is connected to the output controller 7 which responds to the packet address marker S_{PA} by causing all of the output buffers 4, 4' to read the address field of the associated packet. That output buffer 4 or 4' which recognises the bus address BA as its own, is triggered to receive the whole of that packet, which it then passes to a corresponding output packet store 11 or 11' after removing the bus address from the address field.

Each output packet store 11, 11' comprises a buffer which stores the packets it receives in a plurality of FIFO queues each corresponding to a different priority level of the packets. This priority level is identified for each packet by reference to the priority field PR in the packet header which has been added in the input buffer 3 or 3' under the control of the input controller 6 and is deleted once the packet has been directed to a queue. A packet controller 12 controls the order in which the queues are accessed to transfer packets to the output of the store for transmission onwards via a respective line controller 13, 13'. The frequency with which each queue is accessed depends on the priority level of that queue, although any particular queue can be given absolute priority over all others if required, so that this queue is emptied before any of the other queues are accessed.

Considering time delays in the transmission of any packet across the node, there is a minimal variable time delay in the transmission of the packet between the input of the input buffer 3 and input of the output packet store 11. The input buffer 3 only has a limited capacity sufficient to buffer the incoming packet data to adapt it for application to the bus, and this delay is fixed. The bus 5 involves a transmission delay corresponding to a possible timing difference between the arrival of a packet and the occurrence of the next allocated pair of time slots. At maximum, this delay equals the period between successive pairs of time slots, which for a 4 kHz frame marker signal S_{FR} has a maximum value of 250 microseconds. The output buffer 4 operates to receive a complete packet before this is transferred to the output packet store 11, and this incurs a delay corresponding to the packet size. Thus, for any packet switch connection, there is a maximum variable delay time for the transmission of a packet through the node to the output packet store.

The delay incurred in the output packet store 11 is variable and depends upon the priority level of each packet and the length of the corresponding queue to which it is allocated. Under normal operating conditions, this delay is long compared with all other possible variable delays.

The time stamp field TS in the header of each packet is used to provide an accumulative value of the variable transmission delays incurred by a packet in the network. The packet controller 12 includes a timing function represented as 14 in Figure 2 which serves to measure the time each packet spends in a queue of each output packet store 13, 13', and adds this time to that recorded in the time stamp field TS of the packet header before the packet is outputted from the store.

Claims

1. A method of measuring the transmission delay of a packet in a network of one or more nodes comprising measuring the time which the packet spends in an output queue of each node and adding this time to a time stamp field of the packet.

2. A packet transmission system comprising a network of one or more nodes each comprising a number of inputs connected via packet switching means to a number of outputs each of which has storage means associated with it in which to store a queue of packets to be outputted, characterised in that each node is provided with timer means to measure the time each packet spends in a queue of said storage means; and stamping means to add to a time stamp field of each packet before it is outputted from the node, the time the packet has spent in a queue as measured by the timer means.

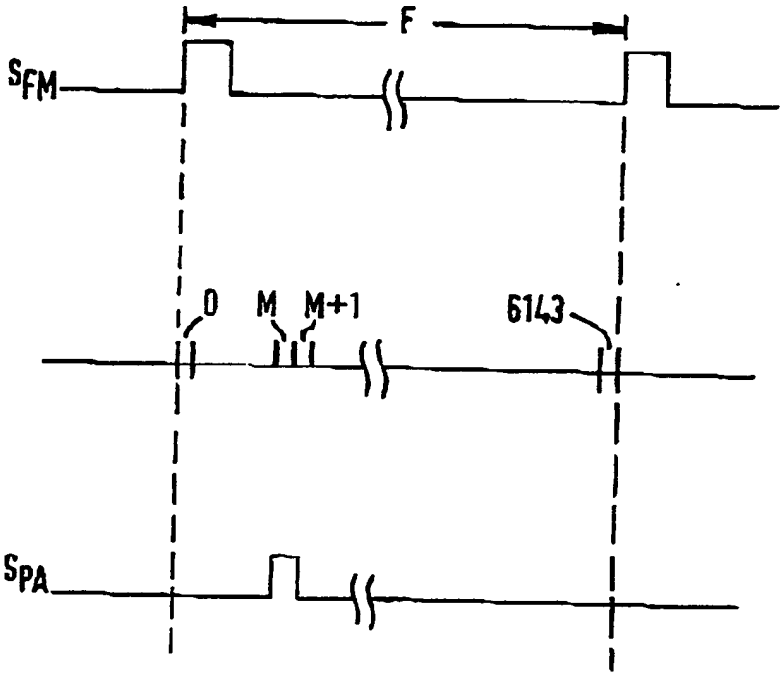

FIG.3.

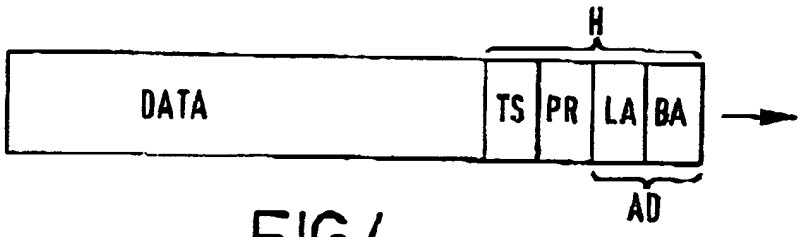

FIG.4.

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